

WHAT IS CLAIMED IS:

1. A trocar for forming an incision in a wall of a target vessel and delivering an anastomosis device for connecting an end of a graft vessel to a target vessel at the site of the incision, the trocar comprising a member having a piercing element at a distal end thereof and the member being adapted to cooperate with a deployment tool such that the anastomosis device can be delivered to the incision site by the deployment tool and the trocar can be withdrawn from the incision site prior to deployment of the anastomosis device.
2. The trocar of Claim 1, wherein the member comprises a tubular member having a passage therein through which the anastomosis device is delivered to the incision site.
3. The trocar of Claim 1, wherein the piercing element comprises a cutting blade which is movable with respect to the member such that the cutting blade can be moved from a cutting position at which the cutting blade is exposed to a retracted position at which the cutting blade is not exposed.
4. The trocar of Claim 1, wherein the piercing element comprises a sharpened inclined surface at the distal end of the member.
5. The trocar of Claim 2, wherein the tubular member includes distal and proximal portions, the distal portion having a smaller diameter than the proximal portion, and the piercing element comprises a sharpened inclined surface being on a free end of the distal portion.

6. The trocar of Claim 5, wherein the distal portion includes at least one axially extending tear line which allows the distal portion to be split and expanded over the deployment tool.

5 7. The trocar of Claim 2, wherein the tubular member comprises a deformable tubular wall.

8. The trocar of Claim 7, wherein the tubular wall includes openings therein which allow the tubular member to be deformed from a smaller configuration to a larger configuration.

10 9. The trocar of Claim 8, wherein the openings are defined by a plurality of axially extending wall sections and a plurality of circumferentially extending wall sections.

10. The trocar of Claim 8, wherein the inclined surface is a continuous surface interrupted by a plurality of slits extending between the inclined surface and the openings located closest to the inclined surface.

15 11. The trocar of Claim 9, wherein the openings comprise axially extending slots arranged in a staggered pattern such that the circumferentially extending wall sections intersect a pair of the slots.

12. The trocar of Claim 7, wherein the deformable tubular wall is made from plastic or metal.

13. The trocar of Claim 1, wherein the piercing element includes a vessel wall piercing portion and a trimming portion, the piercing portion forming the incision upon insertion of the distal end of the member into the vessel wall and the trimming portion removing tissue around the incision upon retraction of the member.

14. The trocar of Claim 13, wherein the member comprises a tubular member and the piercing portion comprises a plurality of axially extending tines at the distal end of the tubular member.

15. The trocar of Claim 13, wherein the piercing portion comprises a plurality of axially extending tines and the trimming portion comprises cutting edges on outer surfaces of the tines or the piercing portion comprises a tapered tip and the trimming portion comprises an anvil surface at one end of the tapered tip.

16. The trocar of Claim 14, wherein distal ends of the tines are biased in close proximity to each other such that the incision can be formed by advancing the tines into the vessel wall, the incision being expanded by spreading of the tines upon delivery of the anastomosis device.

17. The trocar of Claim 1, wherein the piercing element comprises a cutting blade which forms an elongated slit upon insertion of the piercing element into the vessel wall or a tapered tip and anvil surface which forms a rounded incision.

18. The trocar of Claim 17, wherein the member comprises a tubular member which includes tines at the distal end thereof, the tines being separated

from each other and from the cutting blade by axially extending slits.

19. The trocar of Claim 18, wherein distal ends of the tines are biased in close proximity to each other at a location spaced from the distal end of the cutting blade.

20. The trocar of Claim 1, wherein the piercing element includes a plurality of cutting edges spaced circumferentially around the member, the cutting edges forming small slits around the incision.

21. The trocar of Claim 1, wherein the member comprises a tubular member and the piercing element comprises a conical tip of the tubular member.

22. The trocar of Claim 1, wherein the piercing element comprises a blade sized to make the incision smaller than the anastomosis device in a fully deployed condition.

23. A method of performing anastomosis comprising:  
using the trocar of Claim 1 to form an incision in a wall of a target vessel;

inserting the anastomosis device through the trocar into the incision, the anastomosis device having an end of a graft vessel everted around a first portion of the anastomosis device; and

manipulating the first portion of the anastomosis device with respect to a second portion of the anastomosis device to capture edges of the incision in the target vessel with the anastomosis device such that a fluid passage is established between the graft vessel and the target vessel

24. The method of Claim 23, wherein the target vessel is an aorta and the method is performed without clamping of the aorta.

5 25. The method of Claim 23, wherein the end of the graft vessel and the edges of the incision in the target vessel are captured between the first portion and the second portion and the end of the graft vessel abuts an outside of the target vessel, the first portion comprising an inner flange formed by radial expansion of the anastomosis device and the second portion comprising an outer flange formed by axial compression of the anastomosis device.

10 26. The method of Claim 23, wherein the anastomosis device is expandable from a first configuration to a larger second configuration, the method including expanding the anastomosis device with an expander to cause a portion of the anastomosis device to extend outward forming the first flange, the first flange holding a portion of the graft vessel in contact with an inner surface of the target vessel.

15 27. The method of Claim 26, further comprising retracting the trocar over the anastomosis device and along the expander prior to expanding the anastomosis device with the expander, the trocar being deformed during the retracting step.

20 28. The method of Claim 27, wherein the second portion of the anastomosis device is formed by axially compressing the anastomosis device with a deployment tool.

29. The method of Claim 28, wherein the deployment tool comprises a tube which engages a proximal end of the anastomosis device; the compressing step being carried out by moving the expander relative to the tube.

5 30. The method of Claim 29, wherein a groove on the expander engages the anastomosis device during formation of the second portion.

31. The method of Claim 23, wherein the piercing element includes a plurality of cutting edges which form small slits around the incision or the piercing element includes a tapered tip which forms the incision and an anvil surface which enlarges and rounds the incision.

10 32. The method of Claim 23, wherein the anastomosis device comprises an expandable linkage which is delivered through the trocar to the site of the incision, the linkage being deformed to an expanded size during formation of the first and second portions, the incision formed by the trocar being smaller than the expanded size.

15 33. The method of Claim 23, wherein the first and second portions form an angle between about 40 and 140 degrees with an axis of the anastomosis device.